Alberta
ENVIRONMENT

WESTERN AND NORTHERN CANADA ACID DEPOSITION/LRTAP ACTIVITIES

ANNUAL REPORT 1985

A report on monitoring and research studies related to acid rain and long-range transport of atmospheric pollutants in Western and Northern Canada

BC
Ministry of Environment

Saskatchewan Environment

Northwest Territories
Renewable Resources

Manitoba Environment and Workplace Safety and Health

Environment Canada
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A report on monitoring and research studies related to acid rain and long-range transport of atmospheric pollutants in Western and Northern Canada

prepared by the Technical Committee for the Long-Range Transport of Atmospheric Pollutants in Western and Northern Canada

April 1986

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MAP OF WESTERN AND NORTHERN CANADA

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1. INTRODUCTION

Deputy ministers and senior officials from Environment Canada and the environment departments of British Columbia, Alberta, Saskatchewan, and Manitoba met in Edmonton on September 4, 1980, to review available information on acid rain and long-range transport of air pollutants (LRTAP) in Western Canada. At that time, they concluded that acid deposition was not a serious problem in the West. With an increase in industrial activity in Western Canada and the western United States, the deputy ministers subsequently agreed that continued vigilance against acid rain and LRTAP was indeed warranted. They agreed to establish a Consultative Committee of deputy ministers and a Technical Committee of senior officials from the four western provinces and Environment Canada to co-ordinate monitoring, research, and other activities related to acid rain and LRTAP.

In December 1982, the deputy ministers of the participating agencies, which by then included representation from the Northwest Territories, signed an agreement for a three-year research program covering the period 1982 to 1985. The program's objectives included identifying current conditions in Western Canada and providing the information necessary for the agencies to develop appropriate management strategies. Six program priorities were established. These were:

1. To develop maps showing aquatic sensitivity to acid pollution within each province and territory;
2. To develop maps showing soil and geology sensitivity to acid pollution within each province and territory;
3. To monitor background precipitation;
4. To model atmospheric deposition patterns;
5. To maintain inventories of sulphur dioxide and nitrogen oxides emissions; and
6. To monitor surface waters and soils in areas where data are sparse.

Projects addressing these priorities have been completed and the final reports are available from the participating agencies.

In September 1985 the governments of British Columbia, Alberta, Saskatchewan, Manitoba, the Northwest Territories, and Canada signed a second three-year Western and Northern Canada Acid Deposition/LRTAP agreement. The new agreement will cover the period 1985 to 1988, and will address the following eight priorities:

1. Deposition monitoring (including snowpack surveys). This program was implemented during the initial three years of co-ordinated effort, and will continue together with the regular update of emissions inventories. This information will serve as an indicator of any deteriorating changes.
2. Deposition criteria for Western and Northern Canada. It is apparent that the target loading of 20 $kg \cdot ha^{-1} \cdot yr^{-1}$ of wet sulphate used in Eastern Canada may not be appropriate for Western and Northern Canada. In Eastern Canada deposition rates are above 20 $kg \cdot ha^{-1} \cdot yr^{-1}$ at many receptor points and several sensitive ecosystems already show signs of deterioration. The target loading of 20 $kg \cdot ha^{-1} \cdot yr^{-1}$ is intended to protect at least the moderately sensitive aquatic ecosystems. In Western and Northern Canada sensitive aquatic ecosystems are not damaged yet, and the deposition rates are generally below 20 $kg \cdot ha^{-1} \cdot yr^{-1}$. The relative importance of dry deposition and total acid loading criteria are of concern; therefore target loadings for Western and Northern Canada should be developed.
3. Medium-range transport-deposition model. The Atmospheric Environment Service trajectory and deposition model, which has been applied in Western Canada, did not provide sufficient information for making management decisions. A medium-range model on a smaller grid scale is required to better characterize the situation. The long-range transport of air pollutants is less critical in Western and Northern Canada than in Eastern Canada, and receptor points are mainly affected by local sources.
4. Background sulphate ion concentrations and the role of dust. The precipitation chemistry over Western and Northern Canada is different from that over Eastern Canada. The difference in climate is a factor, and the role played by dust may be important in characterizing the precipitation chemistry. It is expected that these studies will assist in evaluating the respective contributions to acid depositions from anthropogenic, local, and background sources.
5. Role of dry deposition. The amount of dry deposition relative to total deposition is not known for Western and Northern Canada. This will be studied

to assist in determining deposition criteria. Monitoring programs and modelling studies will be developed.

6. Monitoring surface water and terrestrial environmental quality. This program is an extension of the one that began in the initial 1982 to 1985 period. The information is needed to fill in gaps in the assessment of potential sensitivity to acid deposition. Identification of long-term trends is important.
7. Impacts in highly sensitive zones. Field studies will be carried out to investigate the impacts on aquatic and terrestrial ecosystems in areas where sulphate loadings are high and in sensitive areas identified through the sensitivity mapping carried out over the past three years.
8. Control technology research methods and strategy options. The technology to control emissions is being reviewed by the Environmental Protection Service. This task will be continued with the aim of assessing the applicability of new control technologies to Western and Northern Canada. Strategy models that provide control options are currently in existence (e.g., the Ontario Model). These will be assessed in terms of their applicability to Western and Northern Canada.

Each agency has undertaken projects to address these priorities. Annual reports and copies of the 1985 to 1988 research and monitoring program are available from the participating agencies.

This document, the fifth annual report of the Technical Committee, summarizes the monitoring and research activities related to acid deposition and LRTAP conducted in Western and Northern Canada during 1985.

2. BRITISH COLUMBIA

2.1 EMISSIONS AND CONTROL TECHNOLOGY

Development of SO_2 and NO_x Emissions Inventory for the Province of B.C. (excluding the Greater Vancouver Regional District)

This project, which began in 1985, has as its key objective the design of an emissions inventory system for major pollutants emitted in the project area. Inventories of SO_2, NO_x, and hydrocarbon emissions thus developed will be used to supplement the data needed in the study of acid precipitation and the modelling of photochemical oxidants generation in various areas of the province.

The design plan calls for an integrated database for the emission of major pollutants from point sources, line sources, and area sources. It involves the determination of emission rates of the pollutants from all sources for the base year 1983. Emission rates will be estimated from permits issued pursuant to the Waste Management Act, and by using appropriate emission factors and surrogates where necessary.

The design of the data file structure and development of computer software will allow easy retrieval of the information in a variety of formats, including emission rate of each pollutant by service, by Waste Management Branch region, etcetera.

The data will be updated regularly, and software modifications will be made as necessary.

Report: Summary reports of emission rates of major pollutants, trend analyses reports, disaggregation of emission rates, and other technical reports will be available from the Waste Management Branch, Ministry of the Environment.

2.2 AIR QUALITY AND DEPOSITION

Snow Sampling in British Columbia

To determine the acidity and chemical composition of the British Columbia snowpack, snow core samples are taken once a year at 16 sites. The samples are analysed for pH, total acidity, alkalinity, SO_4, NO_3, Cl, F, NH_4, Na, K, Ca, Mg, and Al content.

Report: Snowpack Chemistry in South Central British Columbia (paper presented at the Western Snow Conference, 1985 April 16-18, Boulder, CO)

Precipitation Chemistry of Interior British Columbia and Strait of Georgia Monitoring

To determine the chemical composition of precipitation, weekly samples were collected by automatic samplers at six interior stations and six Strait of Georgia stations. The samples were analysed for pH and conventional WMO standard cations and anions.

Report: The annual acid precipitation monitoring reports for 1984 and 1985 are available from the Waste Management Branch, Ministry of Environment.

Strait of Georgia Acid Precipitation Data Analysis

The objective of this project is to determine spatial and temporal variabilities and statistical analyses of Strait of Georgia precipitation chemistry data. Acid precipitation data collected during 1985 at six sites will be entered into a computer and analysed to determine the variability of chemical species within sites and between sites. Factor analysis of water concentrations at six sites will be conducted to study the interrelationship of anthropogenic air pollution and sea-spray sources.

Report: A working report will be available from the Waste Management Branch, Ministry of Environment.

Development of Photochemical Dispersion Models for the Lower Fraser Valley

The objective of the project, which started in 1985, is to develop dispersion models suitable for testing strategies for the control of photochemical oxidants and related pollutants in the Lower Fraser Valley. The project will

1. Develop air quality, emission, and meteorological databases in sufficient detail to allow photochemical modelling of the Lower Fraser Valley;
2. Analyse the interaction of the emissions and prevailing meteorology to determine the ways in which they determine the air quality of the region;

3. Employ photochemical simulation models to test the viability of potential oxidant control strategies; and
4. Investigate the impacts of elevated oxidant levels on the receiving environment.

Report: Air quality and meteorological data summaries and technical reports will be available from the Waste Management Branch, Ministry of Environment.

Mesoscale Model Review

The project, which lasted for five months during 1985, had three key objectives:

1. To investigate and further define modelling and monitoring needs;
2. To investigate the availability of models and make a final selection; and
3. To prepare a plan of action for consideration by the Western and Northern LRTAP Technical and Consultative committees.

Photochemical models and mesoscale models were reviewed to select optimum Lagrangian and Eulerian urban photochemical models and episodic mesoscale models with wet and dry deposition along with sulphur and nitrogen chemistry.

Report: A Review of Mesoscale Modelling for Application to Western Canada

Monitoring and Quality Control

British Columbia continued to participate in the national LRTAP inter-laboratory comparison studies designed to monitor laboratory performance. On behalf of the Western Canada LRTAP Consultative Committee, the province also continued to provide representation on the national LRTAP Quality Assurance Sub-Group.

Report: LRTAP Intercomparison Study reports are available from the Environmental Laboratory, Ministry of the Environment.

2.3 SURFACE WATERS

Lake Trend Monitoring Program

To determine if acidic inputs are causing a significant deterioration trend in lake water quality at sensitive lakes, eight lakes on Vancouver and Saltspring islands and in the Lower Mainland area are monitored on a monthly basis. Samples are analysed for pH, alkalinity, acidity, ions, and metals. From May through October, zooplankton and phytoplankton are collected for identification and counts, and chlorophyll-*a* is measured. Aquatic macrophytes are mapped every five years, at which time grab sediment samples are collected.

Report: Data are available on a lake-specific basis from the Water Management Branch, Ministry of Environment.

Background Lake Monitoring

Staff who are carrying out bathymetric mapping at various lakes that have not been sampled in the past take water samples to increase the database.

Report: Sensitivity of Lakes in British Columbia to Acidic Inputs

The report is available from the Water Management Branch, Ministry of Environment.

2.4 SOILS AND GEOLOGY

Monitoring Soil Changes and Acidic Input Sensitivity of Selected British Columbia Soils

Future reference and comparison of soil conditions to acidic inputs and past conditions requires benchmark information. To acquire such information requires the establishment of long-term monitoring sites and the measuring of changes in acidic input sensitivity-related parameters. From such measurements, trends may be identified and related to changes in acidic inputs.

To date, five long-term monitoring sites in southwestern British Columbia (Lower Mainland) have been tentatively selected, and two others are being considered. A review of parameters and analytical methods for the study is in progress. Analytical results from soil samples submitted for a high acidic input area (related to another study) will be evaluated for suitability of methods.

Report: No report is available at this time.

Soil and Geology Sensitivity Maps for British Columbia

The objectives of the project are to complete a 1:2 000 000 scale base soils and geology map and two sensitivity maps; to reconcile all boundary lines and ratings at borders with those of adjoining provinces and territories; to prepare a report describing the B.C. mapping project and results; to prepare a summary and presentation materials as required; and to prepare a summary description and generalized maps of B.C. for inclusion in a Western Canada report on soil and geological sensitivity.

During 1985, further steps toward finalizing the aforementioned maps included:

1. Refinement of bedrock classes and the resultant base map, and of mapping unit sensitivity ratings;
2. Revision of soil sensitivity rating criteria through conferences with other provinces/territories; and
3. Revision of soil sensitivity ratings for mapping units and revision of maps as necessary.

Report: Revised draft maps of B.C. to scale 1:2 000 000 as follows:

Soil and Geology Characteristics Significant to Acidic Input

Potential of Soil and Geology to Reduce Acidity of Incoming Acid Deposition

Soil Sensitivity to Acidic Inputs

In addition to these revised maps, generalized maps of both soil sensitivity and potential of soils and geology to reduce acidity were prepared for display at the Muskoka Conference and at a B.C. open house on the acid rain program. Also prepared was a summary report to accompany the Muskoka Conference maps.

Information about these materials is available from the Waste Management Branch, Ministry of Environment.

2.5 VEGETATION

Ozone Pollution Impacts on Agricultural Productivity of the Lower Fraser Valley

The objective of the study, which began in November 1985, is to prepare an estimate of the economic impact of ozone pollution on agricultural productivity in the Lower Fraser Valley.

Current production of agricultural crops must be determined. The response relationships of ozone and the crops will be determined from (1) a study of the world literature on regression curves, (2) field simulations, and (3) growth chamber simulations. The precision of the estimates will vary with the availability and applicability of the information.

Report: A brief report will be prepared to present the initial estimate, and will be available from the Waste Management Branch, Ministry of Environment.

Pine Valley Lichen Study

A biomonitoring technique using lichens as bioindicators was described by Peterson and Douglas (1977). The objectives of the study are to evaluate the biomonitoring technique and to determine if adverse environmental impacts were associated with a natural gas processing plant newly constructed near Chetwynd, B.C.

Lichen growth was measured at the start of the project and remeasured after three years. Differences in thallus growth were analysed and recommendations for improvement were presented.

Report: A final report is currently in preparation and is anticipated for mid-February 1986. The report will be available from the Waste Management Branch, Ministry of Environment.

2.6 HEALTH

No activities were conducted in this area.

3. ALBERTA

3.1 EMISSIONS AND CONTROL TECHNOLOGY

Sources and Emissions Inventories

Three types of emissions inventories are prepared by the Air Quality Control Branch of the Pollution Control Division: provincial sulphur emissions, provincial nitrogen oxides emissions, and urban (Edmonton and Calgary) emissions. The sulphur emissions inventory is updated every two years. Annual sulphur emissions (sulphur dioxide expressed as sulphur) for individual plants contributing to the observed (actual) and licensed emissions of each industrial grouping are presented on a year-to-year basis along with trends in both observed and licensed sulphur emissions totals. The nitrogen oxides emissions inventory is also updated every two years (offset by one year from the sulphur emissions inventory). Major industrial, transportation, and combustion sources are included. The urban sources and emissions inventory is scheduled to be updated every five years. Quantities of CO, NO_2, SO_2, THC, and particulates from 12 different sources are included.

Report: Industrial Sulphur Emissions for Alberta 1977-1981

Nitrogen Oxides Emissions for Alberta 1978-1982

Industrial Sulphur Emissions for Alberta 1979-1983 (in preparation)

Nitrogen Oxides Emissions for Alberta 1980-1984 (in preparation)

Exposure Stations

The Exposure Station Program consists of 2112 total sulphation and 1276 hydrogen sulphide static exposure stations. These monitors are primarily located in and around urban centres and industrial areas of the province and are used to identify trends. Chemical analysis is done by the Alberta Environmental Centre (Vegreville), and the results are expressed in equivalent milligrams of SO_3 per 100 square centimetres per day.

Report: Data summaries are available from the Air Quality Control Branch, Alberta Environment.

Gaseous Emissions Control Technology

A wide range of concepts/processes for the control of acid gas emissions was assessed and developed. Source industries such as gas processing, thermal power, oil sands, gas compression, and waste incineration were considered. The use of magnesium oxide to remove sulphur dioxide gas from a sour gas processing plant has been developed and successfully tested at bench scale, and a pilot-scale project is being considered for funding by Environment Canada.

Report: A progress report on the bench-scale tests is available from the Environmental Technology Wing, Alberta Environmental Centre.

3.2 AIR QUALITY AND DEPOSITION

Diffusion and Deposition Modelling from Point Source Emissions

A set of models is maintained to estimate concentrations and deposition downwind of point sources. The level of input data determines the selection of the specific model to be used. New models are added as they become available, and the older ones are upgraded as required. Existing and proposed point sources and complexes of point sources are evaluated for regulatory purposes. Occasionally, guide models are promulgated for general use.

Report: A guide for estimated sulphur deposition resulting from point source emissions and the computer codes (SULDEP2 and FREDIS) are available from the Pollution Control Division, Alberta Environment.

Precipitation Quality Monitoring Network

The chemical composition of precipitation is monitored at several permanent sites in Alberta. The objective of the project is to detect significant changes resulting from industrialization within the province and to provide a historical database.

Report: Data reports are produced annually, and a five-year summary is in preparation. These reports are available from the Pollution Control Division, Alberta Environment.

Evaluation, Analysis, and Assessment of Snowpack and Precipitation Chemistry Data from a Monitoring Network in the AOSERP Study Area

The Research Management Division has since 1976 sampled and chemically analysed (1) the accumulated snowpack and (2) event rainfall in the AOSERP area. During this time neither the network operation nor analytical data have been subjected to a rigorous evaluation, assessment, and analysis. The objectives of the study were:

1. To subject the network operation and its data to quality control evaluation;
2. To transform the current database (which consists of a multiplicity of free format computerized files) into a consistent archive (in the NAQUADAT format);
3. To determine, through statistical and other analyses of the data, the temporal and spatial trends or patterns in the deposition of the monitored pollutants and to assess the historical impact of industrial development on precipitation quality in the study area;
4. To assess the suitability of the existing network and to recommend improvements; and
5. To conduct a preliminary assessment of the impact of future emissions from local industrial sources on precipitation quality in the network.

Report: A final report will be available in 1986 from the Research Management Division, Alberta Environment.

Investigation of Ion Imbalance in Precipitation Chemistry

Ion imbalances have been quantified primarily in the chemical analyses of summer precipitation samples collected in the oil sands region and to a lesser degree in the winter precipitation samples. The complete characterization of precipitation chemistry is essential to assess the potential impacts on the environment. The underlying causes for ion imbalances may originate from both physical and chemical factors. The objectives of this project will be directed only toward examining the effect of the following chemical factors on the ion imbalance: (1) the effect of analytical variability of each chemical element over the entire analytical range; (2) the quantification of other chemical species that may exist in the samples, such as organic acids and oxalates; and (3) the evaluation of techniques for measuring acidity and alkalinity..

Reports: Results of the study will be available from the Research Management Division, Alberta Environment.

Air Quality Data Acquisition in the Oil Sands Area of Northeastern Alberta

An air quality monitoring station was established in the oil sands area near Fort McMurray. The station will measure on a continuous basis both meteorological data and ambient concentrations of acid forming gases. This information will be beneficial in assessing the response of terrestrial ecosystems to pollution episodes. The data generated will be used to develop numerical models for interfacing atmospheric air quality data with receptor response measurement.

Report: Interim reports will be available from the Research Management Division, Alberta Environment.

3.3 SURFACE WATERS

Aquatic Sensitivity Mapping

Maps of the sensitivity of surface waters in Alberta to deposition of acid forming emissions are being prepared. Parameters of concern include pH, calcium, magnesium, alkalinity, and total dissolved solids.

Report: A final report is in preparation and will be available from the Research Management Division, Alberta Environment.

River Monitoring Network

The objective of the project, which began in 1977, is to establish long-term databases for selected locations on major Alberta rivers to allow analyses of long-term trends. Eleven stations are monitored on a monthly basis.

Report: Annual reports are available from the Water Quality Control Branch, Alberta Environment. A long-term trend report, covering 10 years, will be prepared in 1987.

3.4 SOILS AND GEOLOGY

Soil Sensitivity Mapping

The objective of the project, which began in 1984, is to prepare maps of Alberta at 1:2 000 000 scale depicting the distribution of soils relative to sensitivity to acid deposition and potential to neutralize acid deposition. Approximately 400 unique map units have been identified, described, and interpreted.

Report: A soils map of the province at 1:2 000 000 scale that synthesizes the best available soil data for the province is now available.

It is expected that the soils maps and report will be available from the Alberta Research Council in April 1986.

Sensitivity of Soils in Alberta to Acid Additions

In an attempt to map soils on the basis of their sensitivity to acidification, the project investigated (1) whether soil survey information could be used to assess relative sensitivity of soils and (2) which soil characteristics are most useful in predicting buffering capacities. It was concluded that present mapping based on soil series does allow a wide variety of soil chemical properties to be distinguished. Current emphasis on cation exchange capacity for soil sensitivity is supported by this project.

Report: A final report will be available in June 1986 from the Earth Sciences Division, Alberta Environment.

Seasonal Fluctuations in Soil pH

The project was initiated in 1983 to document the relative importance of seasonal variations in soil chemical properties as an aid to identifying long-term acidification. A statistical model has been developed that considers the implications of spatial and temporal variation for the process of monitoring for soil acidification.

Report: A detailed report documenting the spatial and temporal variability in soil pH at seven sites over a two-year period is available from the Earth Sciences Division, Alberta Environment.

Long-Term Measurement of the Acidification of Non-Cultivated Soils in Alberta

Eight monitoring sites have been established to measure the acidification of soils over a long period of time in areas where deposition of industrial acid precursors is expected. The monitoring sites are intended to measure the worst situations, hence they will act as soil acidification early warning sites. Two sites are sampled each fall. All sites will be resampled once every four years.

Report: A brief synthesis of procedures is available from the Earth Sciences Division, Alberta Environment.

3.5 VEGETATION

Atmosphere-Biosphere Interface: Verification of the Model to Determine the Frequency Distribution of SO_2 Ground Level Concentrations

A frequency distribution model capable of predicting the magnitude and frequency of occurrence of ground level sulphur dioxide (SO_2) concentrations is being validated using actual SO_2 data collected in the Fort McMurray area. The validated model will be used to predict the frequency distribution of ground level SO_2 concentrations throughout the oil sands area. Areas in which there is maximum SO_2 impact will then be selected for ecological studies to assess the potential impacts of acidification.

Report: A final report will be available in the fall of 1986 from the Research Management Division, Alberta Environment.

Atmosphere-Biosphere Interface: Application of a Numerical Model to Assess Growth Response of Jackpine to Chronic Atmospheric SO_2 Exposures

The correlation between the output of a validated model predicting the frequency distribution of sulphur dioxide (SO_2) ground level concentrations and the tree wood production in several jackpine stands will be determined. Located in the Fort McMurray region, the project will attempt to assess growth effects due to chronic exposure to SO_2.

The Response of Vegetational Communities to Aerial Emissions

The short- and long-term responses of vegetational communities to aerial emissions are being investigated through this project. Initially, annual surveys were done at several sites; however, numerous observations are now made throughout the growth cycle at four selected sites. A precise determination of phenological parameters will be made to permit correlation with continuous air quality data.

Report: Several annual reports are now available and a summary report covering four years of data collection will be available in 1986 from the Research Management Division, Alberta Environment.

Impacts of Air Pollutant Mixtures on Forest Vegetation and Soils

The study is designed to use both laboratory and field investigations to identify and quantify forest tree responses to single and multiple exposures of acid forming pollutants. For the Athabasca Oil Sands area, a predictive capability for changes in forest soils and vegetation will be made. Both current and future rates of pollution deposition are considered.

Report: Interim reports are now available and a final summary report will be available in the spring of 1986 from the Research Management Division, Alberta Environment.

3.6 HEALTH

Health Effects of Sulphur Gases

The objective is to determine the effects of toxic or potentially toxic gases, vapours, particulates, and aerosols on animals and, by extrapolation, on humans. Current studies include the characterization of a 69 L inhalation exposure chamber, commissioning of a new 359 m^2 inhalation toxicology containment facility, studies on the acute toxicity of hydrogen sulphide, in vitro studies and techniques for evaluation of adverse effects of pneumotoxicants, implementation of an inhalation exposure system using 2 m^3 exposure chambers, and field investigations of possible effects on livestock.

Report: Reports are available from the Alberta Environmental Centre, Toxicology Group.

NOTE: The Alberta Government and Alberta industry jointly sponsor specific acid gas-related studies through the Acid Deposition Research Program (ADRP). For a complete description of this program, please refer to the Industry and Institution Activities section (9.2) of this report.

4. SASKATCHEWAN

4.1 EMISSIONS AND CONTROL TECHNOLOGY

Saskatchewan Air Emissions Inventory of Sulphur Dioxide and Nitrogen Oxides

The inventory of sulphur dioxide and nitrogen oxides emissions is being updated for 1983. The inventory will be prepared according to the methods outlined in the emissions inventory methods manual developed by the Western Canada LRTAP Inventory Technical Working Group.

Report: A final report will be available in 1986 from the Air Pollution Control Branch, Saskatchewan Environment.

4.2 AIR QUALITY AND DEPOSITION

Poplar River Thermal Power Plant Ambient Air Monitoring Program

Saskatchewan Environment monitors sulphur dioxide and suspended particulates at one location, Coronach.

Report: Data summaries are available from the Air Pollution Control Branch, Saskatchewan Environment.

Snowpack Chemistry in Northern Saskatchewan

To supplement the snowpack chemistry studies conducted in northern Saskatchewan, Saskatchewan Environment has established a long-term snowpack chemistry monitoring program. The program involves the annual collection of snow samples at seven sites in northern Saskatchewan. The samples will be analysed for pH, sulphate, nitrate, chloride, ammonium, alkalinity, and metal ions scan. The next set of samples will be collected in February or March 1986.

Report: Data summaries will be available from the Air Pollution Control Branch, Saskatchewan Environment.

Chemistry of Summer Precipitation in Northern Saskatchewan

Rainfall is collected, on an event basis, at seven sites in northern Saskatchewan. Chemical analyses for sulphate, nitrate, chloride, ammonium, potassium, calcium, sodium, magnesium, pH, alkalinity, and metal ions scan provide data for evaluation of deposition rates.

Report: Data summaries are available through the Air Pollution Control Branch, Saskatchewan Environment.

The Origin of Strong Acidity in the Snowpack of Northern Saskatchewan

Snow cores were collected from two sites, the Haultain Lake area and the Wollaston Lake area, in northern Saskatchewan. A complete ion balance was conducted on the core samples. The purpose of the study was to quantify the extent of the acidity and to determine if organic acids are making a contribution to the total ion balance.

Report: A report will be available in 1986 from the Air Pollution Control Branch, Saskatchewan Environment and the Saskatchewan Research Council.

4.3 SURFACE WATERS

Surface Water Sampling in Northern Saskatchewan

Approximately 60 surface water stations in northern Saskatchewan are monitored. Most of the samples are collected by industry at the request of Saskatchewan Environment.

Report: Data summaries are available from the Mines Pollution Control Branch, Saskatchewan Environment.

Surface Water Sampling in Southern Saskatchewan

Saskatchewan Environment collected surface samples at about 40 lakes in southern Saskatchewan during 1985. The data were collected to provide background information for the lake sensitivity mapping program. The samples were analysed for pH, sulphate, nitrate, calcium, magnesium, alkalinity, and aluminum. In addition, associated ions, metals, nutrients, and solids measurements were made.

Report: Data summaries are available from the Air Pollution Control Branch, Saskatchewan Environment.

Lake Water Chemistry for Small Lakes in Northern Saskatchewan

A long-term lake water chemistry monitoring program was initiated by Saskatchewan Environment in 1984.

The program involves the collection of water samples each year at 22 sites uniformly distributed throughout northern Saskatchewan. The samples are analysed at a minimum for pH, sulphate, nitrate, calcium, magnesium, alkalinity, and aluminum. In addition, associated ions, metals, nutrients, and solids measurements are made.

Report: Data summaries are available from the Air Pollution Control Branch, Saskatchewan Environment.

Lake Sensitivity Mapping

Preliminary lake sensitivity maps have been prepared for the province: one based upon alkalinity data, one based upon calcium data, and one in which sensitivity classifications for both calcium and alkalinity maps are combined. The maps have been modified at the borders to match up with maps being prepared by Alberta and Manitoba. All maps are based on criteria outlined by the Co-ordinating Committee on Surface Waters.

Report: Copies of these maps will be available in 1986 from the Air Pollution Control Branch, Saskatchewan Environment.

4.4 SOILS AND GEOLOGY

Soils and Geology Sensitivity Mapping

Maps of Saskatchewan depicting soils and geology sensitivity to acid precipitation have been prepared by the Saskatchewan Institute of Pedology. The maps have been modified at the borders to match up with the maps being prepared by Manitoba and Alberta. The maps are based on the criteria outlined by the Co-ordinating Committee on Soils and Geology Sensitivity Mapping.

Report: The map and a report will be available in 1986 from the Air Pollution Control Branch, Saskatchewan Environment and the Saskatchewan Institute of Pedology.

4.5 VEGETATION

An Evaluation of the Sensitivity of Saskatchewan Forest Vegetation and Field Crops to Acidic Precipitation

A laboratory study is being conducted by the Saskatchewan Research Council involving the use of simulated acid rain to evaluate the response of common Saskatchewan forest trees and field crops to various levels of precipitation acidity under controlled growth-room conditions.

Report: A report will be available by mid-1986 from Saskatchewan Environment and the Saskatchewan Research Council.

4.6 HEALTH

Long-Range Transport of Air Pollutants Health Effects

A joint epidemiological study between Health and Welfare Canada and Saskatchewan Environment is being conducted in 1985 and 1986 on school-aged children to assess the potential risk to human health from the long-range transport of air pollutants. Details of this study are outlined in Section 8.6

5. MANITOBA

5.1 EMISSIONS AND CONTROL TECHNOLOGY

No specific studies are underway with respect to emissions and control technology. However, emission inventories for nitrogen dioxide and sulphur dioxide are being maintained by the province.

Report: A report of nitrogen dioxide and sulphur dioxide emissions for the years 1981 and 1982, as well as a data summary for the succeeding years, is available from Manitoba Environment and Workplace Safety and Health.

5.2 AIR QUALITY AND DEPOSITION

Air Quality Monitoring in Northern Manitoba

Atmospheric sulphur dioxide is measured on a continuous basis downwind from the two major non-ferrous smelters at Flin Flon and Thompson. The network consists of two stations within the Flin Flon area and one in Thompson. Total reduced sulphur compounds are measured at one site near the MANFOR kraft pulp and paper mill at The Pas.

Report: Data summaries and reports are available from Manitoba Environment and Workplace Safety and Health.

Precipitation Monitoring

Precipitation is sampled on a daily event basis at Norway House, Island Lake, Gillam, Brochet, Winnipeg, and Pointe du Bois. The following parameters are analysed: pH, conductance, acidity, sulphate, nitrate, chloride, calcium, ammonium, magnesium, sodium, and potassium.

Report: Data summaries and reports are available from Manitoba Environment and Workplace Safety and Health.

Snowpack Survey

A winter snowpack survey is being conducted within the boreal forest ecosystem surrounding the smelters in Flin Flon and Thompson. Seven sampling sites are located around Flin Flon and twelve near Thompson. At each site replicate samples are taken with a Mount Rose sampler and analysed for pH, sulphate, zinc, lead, copper, nickel, iron, cadmium, and arsenic.

The snowpack survey includes 18 stations throughout the province. Samples are analysed for pH, conductance, acidity, sulphate, nitrate, chloride, calcium, ammonium, magnesium, sodium, and potassium.

Report: Data summaries are available through Manitoba Environment and Workplace Safety and Health.

5.3 SURFACE WATERS

Surface Water Sampling

Approximately 1800 sites, located within NTS map sections 63K, 63N, and 63O of northern Manitoba, were sampled as part of a Geochemical Reconnaissance Program operated jointly by the Manitoba Geological Services Branch and the federal government. The chemical analyses of the surface water samples are being carried out by Manitoba Environmental Management.

Report: Data summaries are available through Manitoba Environment and Workplace Safety and Health.

Aquatic Sensitivity Mapping

Existing water quality data were compiled and a draft computer-drawn aquatic sensitivity map was constructed with the assistance of Environment Canada.

Report: Data summaries are available through Manitoba Environment and Workplace Safety and Health.

5.4 SOILS AND GEOLOGY

There are no routine soils monitoring programs in progress.

Terrestrial Sensitivity Mapping

Terrestrial sensitivity mapping was completed in cooperation with other jurisdictions of Western Canada.

Report: Two maps have been produced at a scale of 1:2 000 000. These are:

Sensitivity of Soils to Acidic Inputs

Potential of Soils and Bedrock to Reduce the Acidity of Incoming Acidic Deposition

Maps and data are available through Manitoba Environment and Workplace Safety and Health.

5.5 VEGETATION

Vegetation Surveys around Thompson: Tree Seedling Studies

Greenhouse studies of tree seedling growth in soil from Thompson, which contains high levels of metals, have been completed.

Report: A report is available from Manitoba Environment and Workplace Safety and Health.

Tree Regeneration Study near Thompson

To follow up the greenhouse studies, four plots have been established near Thompson with financial assistance from Inco Limited to study on site the effect of plant growth under the conditions created by the Thompson smelter. Tree seedlings have been transplanted on the study plots and soil surveys have been completed.

Report: The study is ongoing. Interim results are available from Manitoba Environment and Workplace Safety and Health.

Forest Impact Study of Smelter Emissions in Northern Manitoba

Forest vegetation in the Thompson and Flin Flon areas was evaluated for impacts from smelter emissions. A report summarizing five years of studies has been prepared.

Report: A report is available from Manitoba Environment and Workplace Safety and Health.

Terrestrial Monitoring

In co-operation with the federal ARNEWS program (see Section 7.5), five monitoring sites were established in 1985. Of these sites, four are under federal/provincial management and one is provincially managed. Four additional sites are planned for 1986.

Report: Baseline data have been collected, and data summaries will be available from Manitoba Environment and Workplace Safety and Health.

5.6 HEALTH

Mercury in Mink and Otter

Mercury levels in mink and otter in the Rat-Burntwood system have been monitored.

Report: This is an ongoing program. Summary data are available from Manitoba Environment and Workplace Safety and Health.

6. NORTHWEST TERRITORIES

6.1 EMISSIONS AND CONTROL TECHNOLOGY

No activities were conducted in this area.

6.2 AIR QUALITY AND DEPOSITION

Monitoring Background Precipitation

There are currently six Northwest Territories Precipitation Chemistry Network (NWTPCN) stations located in the Northwest Territories. In 1985, precipitation samples were taken at Yellowknife.

Report: Further information is available from the Pollution Control Division, Department of Renewable Resources.

6.3 SURFACE WATERS

Aquatic Sensitivity Mapping

Based on the historical water quality data gathered by the Department of Renewable Resources, the Inland Waters Directorate (IWD) redrafted the aquatic sensitivity map prepared in 1984.

Report: Further information is available from the Pollution Control Division, Department of Renewable Resources (Yellowknife) or from the Inland Waters Directorate (Regina).

6.4 SOILS AND GEOLOGY

There are no routine soil monitoring programs in progress.

Soils and Geology Sensitivity Mapping

Maps presenting the potential of soils and bedrock in the Northwest Territories to reduce the acidity of precipitation are being prepared. Soil depth, soil texture, bedrock exposure, and bedrock lithology are used for these interpretations. The maps are based on guidelines prepared by the Task Group on Soils and Geology Sensitivity Mapping to ensure compatability with those prepared by the western provinces and the Yukon Territories.

Report: Further information is available from the Pollution Control Division, Department of Renewable Resources.

6.5 VEGETATION

No activities were conducted in this area.

6.6 HEALTH

Polar Bear Study

To determine PCB and other organochlorides concentrations in polar bears, the NWT Wildlife Service and the Canadian Wildlife Service took tissue samples from polar bears.

Report: Further information is available from the Wildlife Service, Department of Renewable Resources (Yellowknife) and the Canadian Wildlife Service (Edmonton).

Blood Samples — Native Population

The federal departments of Health and Welfare, Indian and Northern Affairs, and Fisheries and Oceans undertook a health study of the community of Broughton Island, testing breast milk and blood samples to determine PCB concentrations.

Report: Further information is available from Health and Welfare Canada (Ottawa).

7. FEDERAL GOVERNMENT

7.1 EMISSIONS AND CONTROL TECHNOLOGY

Abatement of Acid Gas Emissions — Phase 1: Use of Wet Scrubbing Flue Gas Desulphurization at Sulphur Recovery Plants

The objectives of the study were to:

1. Prepare cost estimates of wet scrubbing flue gas desulphurization (FGD) processes for retrofitting to existing Alberta sour gas industry sulphur recovery facilities; and
2. Review the potentially saleable by-products, gypsum and epsom salt.

The cost estimates were to be used to determine whether future research and development should be undertaken. To date, capital and operating costs have been derived for five wet scrubbing FGD processes: limestone with forced oxidation; wet lime with forced oxidation; wet lime with sludge disposal; MgO with regeneration; and MgO with forced oxidation. Comparisons with existing state of the art tail gas cleanup (TGCU) processes have been made. Based on the report and industry feedback on the report, it was determined that further R&D is not warranted at this time.

Report: Further information is available from the Environmental Protection Service Western and Northern Region, Environment Canada.

Western Canada Sulphur Dioxide and Nitrogen Oxides Atmospheric Emission Inventory Methods Manual (1986 Edition)

The Air Emission Inventory Working Group was requested by the Western and Northern Canada LRTAP Technical Committee to prepare a manual containing standard procedures for the compilation of SO_2 and NO_x atmospheric emissions data from point and area sources across Western Canada that could be used by all agencies to ensure uniformity of recording and reporting emissions data. The manual, which will be updated every two years, contains current methodologies, including emissions factors for the estimation of SO_2 and NO_x atmospheric emissions.

Report: The report and further information is available from the Environmental Protection Service Western and Northern Region, Environment Canada.

1983 Western Canada Sulphur Dioxide and Nitrogen Oxide Atmospheric Emissions

Industrial point sources and diffuse area sources of SO_2 and NO_x emissions are currently being inventoried by provincial agencies across Western Canada for the base year 1983. Each of these inventories is prepared using a recently developed manual, then submitted to EPS for regional information and publication through the LRTAP Technical Committee. Information is published both on a "by province" and "sector-wide" basis. The inventory will be published every two years.

Report: It is expected that the 1983 inventory will be completed by March 1986.

A Review of Flaring in the Sour Gas Industry with Particular Reference to the Emission of Pollutants

The objectives of the project were to prepare a state of the art review of the emission of pollutants, including organic chemical compounds, from the flare stacks of natural gas processing plants during periods of upset operating conditions, and to devise a research program for the sampling and analysis of flare gases. The report contains a detailed literature review of sour gas industry flaring, a review of the wide variation in flare stack operating conditions, and a review of the many problems associated with emission testing. A detailed multi-year study program was proposed to overcome information deficiencies identified in the report.

Report: The report and further information are available from the Environmental Protection Service Western and Northern Region, Environment Canada.

Acid Rain Research and Monitoring Studies in British Columbia, the Yukon, and the Pacific Northwest

The project was designed to review ongoing and planned studies in acid rain research and monitoring. A final report has been prepared and circulated to co-operating agencies in British Columbia and the Pacific Northwest.

Report: Further information is available from Agriculture Canada.

7.2 AIR QUALITY AND DEPOSITION

Oceanic Background Sources of Chemicals Contributing to Acidity in Marine Precipitation

To assess the natural background values of acidity and chemicals contributing to acidity in marine precipitation, precipitation and aerosol samples have been collected aboard ships since 1981 along a line from Juan de Fuca Strait to Station PAPA (50°N, 145°W) and analysed for their chemical composition.

Report: Further information is available from the Institute of Ocean Sciences, Atmospheric Environment Service.

Hydrometeorology of CANSAP Sampler

To determine the evaporative loss and under-catch of the CANSAP sampler, CANSAP and CAPMON samplers have been installed at the Regina airport. Samples are weighed daily, and a comparison of the sample weights is made.

Report: Further information is available from the Atmospheric Environment Service Central Region, Environment Canada.

Northwest Territories Precipitation Chemistry Network

To augment the precipitation chemistry network in the NWT in order to monitor background wet deposition in the region, six sampling stations (Baker Lake, Coppermine, Cambridge Bay, Norman Wells, Contwayto, and Fort Smith) were established. Event samples were collected for analysis. The results are being evaluated to determine whether the network should be continued.

Report: Further information is available from the Atmospheric Environment Service Western Region, Environment Canada.

Western Canada Mesoscale Deposition Modelling

To obtain and apply a statistical Long-Range Transport of Air Pollution model suitable for application on the mesoscale, a contract was let to obtain codes for, and implement, three prospective candidate models. Tests of the models will be conducted using suitable data sets, such as those from the Alberta Hail Research Project area. Applications will follow the testing period.

Report: Periodic progress reports will be available from the Atmospheric Environment Service Western Region, Environment Canada.

Canadian Network for Sampling Precipitation (CANSAP) and Canadian Air and Precipitation Monitoring Network (CAPMON)

Stations in this network have samplers that open only during precipitation events. Samples are removed daily, and analysed on a monthly basis for pH, conductivity, sulphate, nitrate, chloride, ammonium, potassium, sodium, magnesium, and calcium. The network includes the following distribution in Western and Northern Canada:

Alberta
- Fort McMurray
- Edson
- Coronation
- Lethbridge
- Rocky Mountain House

Saskatchewan
- Cree Lake
- Kindersley
- Wynyard

British Columbia
- Fort St. John
- Fort Nelson
- Vancouver
- Terrace
- Prince George
- Kelowna
- Port Hardy
- Revelstoke

Northwest Territories
- Hay River
- Inuvik
- Fort Reliance
- Mould Bay

Yukon
- Whitehorse

The CANSAP network is being replaced by CAPMON, which will provide improved quality assurance for the sampling and analysis of atmospheric constituents through the upgrading of siting and instrumentation, implementation of revised laboratory procedures, and

use of a computerized archiving system. Conversion of the CANSAP network to CAPMON has been completed in Manitoba and Eastern Canada; two CAPMON stations are in operation in Manitoba at Island Lake and McCreary, and one in northern Saskatchewan at Cree Lake.

Report: Data summaries are published routinely and are available from the Atmospheric Environment Service, Environment Canada.

Regional Trajectories

To test the potential of existing wind/trajectory models and data available on the AES headquarters computer to produce regional-scale trajectories, a comparison of trajectories produced by the AES trajectory model and those produced by smaller-scale regional wind models was begun. The trajectories produced will be verified against analysed wind fields and aircraft tracking data where available.

Report: Further information is available from the Atmospheric Environment Service Western Region, Environment Canada.

British Columbia Transboundary Precipitation Chemistry

A precipitation event monitoring network located on a line parallel to the United States-Canada border was established in 1983 to monitor the concentration of atmospheric pollutants in precipitation in southwestern B.C. The network continued operation throughout 1985, at which time two sites in the Strait of Georgia were added. Data will be analysed to determine the effects of the shutdown, in March 1985, of a major SO_2 emitter (i.e., the ASARCO smelter) located in Tacoma, Washington.

Report: Various reports and data are available from the Atmospheric Environment Service Pacific Region, Environment Canada.

West Coast British Columbia Background Sulphate

To determine the background concentration of sulphate in precipitation along Canada's west coast, a contract has been let to provide quality control and analysis of available precipitation chemistry data. The contractor will select a suitable method from the literature to determine background values and, using the method, estimate the background sulphate concentration.

Report: A report is expected in late 1986.

7.3 SURFACE WATERS

Field Electronic Data Acquisition

The objectives of the project are to:

1. Develop electronic measurement capability;
2. Evaluate the potential for reducing water quality monitoring costs through automated data-gathering methods;
3. Collect data for the evaluation of the statistical nature of water quality parameters in coastal streams; and
4. Determine the effects of rain events on stream pH.

A data acquisition station is currently located at the Salmon Enhancement Program Hatchery in Maple Ridge in the Kanaka Creek Watershed of British Columbia. Monitoring of the following variables has been conducted since July 1984 at 15-minute intervals: pH, conductivity, depth, oxidation reduction potential, dissolved oxygen, and temperature. These data have been collected with a Hydrolab 8000 and transferred to a microcomputer on a weekly basis.

Report: High Frequency Water Quality Monitoring of a Coastal Stream (IN proceedings from the Workshop on the Statistical Aspects of Water Quality Monitoring)

Further information is available from the Water Quality Branch, Inland Waters Directorate Pacific and Yukon Region, Environment Canada.

Pacific Region Baseline Surface Water Chemistry Monitoring

The initial program began in 1981. The current program will run from October 1985 to March 1986, and subsequent programs are anticipated. The objective of the surface water sampling program is to characterize Pacific salmon stream sensitivity to acid depositions. Weekly to monthly sensitivity data (pH, alkalinity, conductivity, metals) are collected on selected lower order salmon streams in the Pacific Region. Areas downwind of the Vancouver Lower Mainland and those adjacent to transboundary sources have been included.

Report: DFO Technical Report #1388, June 1985

DFO Technical Report #1389, July 1985

The reports are available from the Department of Fisheries and Oceans.

7.4 SOILS AND GEOLOGY

Yukon Soils and Geology Sensitivity Mapping

The objective of the project is to produce maps of (1) the potential of soil and geology to reduce the acidity of incoming acid deposition affecting the aquatic resource and (2) soil sensitivity to acid deposition affecting vegetation.

Report: Preliminary maps are available from Agriculture Canada.

7.5 VEGETATION

Acid Rain National Early Warning System (ARNEWS)

The Acid Rain National Early Warning System was established to clearly and accurately detect early signs of acid rain damage to forests before damage becomes obvious. A nation-wide network of permanent plots has been established by the Canadian Forestry Service to detect and monitor changes in forest soil, vegetation, and trees. A total of 15 plots will be established in the Pacific Region and 15 in the Northern Region during the three-year period 1984-1987. ARNEWS plots will remain in existence for a planned 20- to 25-year period.

Report: Further information is available from Agriculture Canada.

Analysis of Existing Ecosystem Chemistry Data Pertinent to the ARNEWS Plot Established near Spur 17 in the UBC Research Forest

The objective of the project is to supply the Canadian Forestry Service with ongoing analyses of long-term soil, water, and precipitation chemistry gathered adjacent to the ARNEWS (Acid Rain National Early Warning System) plot.

Report: Further information is available from Agriculture Canada.

Comparison of Tree Ring Chemistry and Changes in Growth Rates in Areas Impacted by Acid Rain in Southwestern British Columbia

The objective of the project is to identify changes in tree growth rates, if any, and to analyse growth rings for trace element accumulation and wood density. Historic deposition rates are to be derived and compared with or related to any changes noted in growth rates.

Report: Further information is available from Agriculture Canada.

Forest Insect and Disease Survey (FIDS)

The objective of the program is to obtain baseline data on the concentrations of foliar and soil elements, foliar and tree condition (including insect and disease levels), and tree growth. The baseline studies are to be followed up by detection and monitoring of possible changes to the baseline states.

Nine nationally standardized forest plots have been established as part of the ARNEWS program in British Columbia. An additional six plots will be established in 1986.

To obtain a more immediate assessment of the condition of the forest in British Columbia, subjective observations were undertaken at 417 of the province-wide permanent sample plots.

Report: Further information is available from Agriculture Canada.

7.6 HEALTH

No activities were conducted in this area.

8. JOINTLY MANAGED ACTIVITIES

8.1 EMISSIONS AND CONTROL TECHNOLOGY

Air Pollution Emission Inventory

A nation-wide inventory of sources and emissions of air contaminants is published biannually. The report on 1982 data is being completed.

Report: Earlier reports and further information are available from the Environmental Protection Service, Edmonton and Vancouver.

B.C. Lower Mainland Oxidant Emission Inventory

The B.C. Ministry of Environment, the Environmental Protection Service, and the Greater Vancouver Regional District embarked on a joint project to establish a detailed inventory of oxidant-related emissions throughout the Lower Mainland area. Investigations in 1985 centred on the database design.

Report: No report is available at this time.

8.2 AIR QUALITY AND DEPOSITION

National Air Pollution Surveillance (NAPS)

NAPS stations are operated co-operatively by federal and provincial agencies in each of the western provinces. Measurements include sulphur dioxide, nitrogen oxides, carbon monoxide, ozone, and/or particulates.

The distribution of NAPS stations is as follows (bracketed numbers indicate the number of stations in each location):

Manitoba
- Winnipeg (3)
- Brandon (1)

Saskatchewan
- Regina (2)
- Saskatoon (2)
- Moose Jaw (1)
- Lloydminster (2)
- Estevan (2)

Alberta
- Edmonton (7)
- Calgary (5)
- Red Deer (1)
- Medicine Hat (1)
- Lethbridge (1)

British Columbia
- Greater Vancouver Regional District (12)
- Prince George (1)
- Victoria (1)
- Kamloops (1)
- Penticton (1)

Northwest Territories
- Yellowknife (1)

Yukon
- Whitehorse (1)

Report: Data summaries are available from the provincial environment departments or the Environment Protection Service at major centres.

8.3 SURFACE WATERS

No activities were conducted in this area.

8.4 SOILS AND GEOLOGY

No activities were conducted in this area.

8.5 VEGETATION

Effect of Pulsed Acid Stress on Periphyton Communities Grown on Artificial Substrates

The objective of the project, jointly conducted by the University of Victoria and the B.C. Ministry of Environment, is to establish the likely impact of pulsed acid stress on periphyton communities in oligotrophic waters. To do this, it will be necessary to:

1. Develop, on artificial substrates, standardized periphyton biofilms in selected lakes known to be unaffected by acid precipitation;
2. Use these attached organisms in special aquariums to determine whether community dominance shifts occur at sub-optimal pH's (including pulsed conditions); and
3. Examine these pH-stressed communities for specific alterations in species richness and diversity and, if possible, identify resistant communities.

To date, the necessary apparatus has been built and is operational.

Report: A report is due in March 1986, and will be available from the Waste Management Branch, Ministry of Environment.

8.6 HEALTH

Long-Range Transport of Air Pollutants Health Effects

A joint epidemiological study between Health and Welfare Canada and Saskatchewan Environment is being conducted in 1985 and 1986 on elementary school-aged children to assess the potential risk to human health from the long-range transport of air pollutants.

Five communities have been selected in Ontario in an area affected by the long-range transport of air pollutants. Five communities have also been selected in Saskatchewan, an area that is not affected by the long-range transport of air pollutants. The risk to human health will be determined by comparing the data collected from the two areas. The study includes ambient air monitoring of sulphur dioxide, ozone, nitrogen dioxide, carbon monoxide, suspended particulates, and inhalable particulates in each area.

Report: Further information is available from National Health and Welfare Canada and the Air Pollution Control Branch, Saskatchewan Environment.

9. INDUSTRY AND INSTITUTION ACTIVITIES

9.1 BRITISH COLUMBIA

Ozone Sensitivity of Agricultural Crops

The Zonal Air Pollution System technique established at the University of British Columbia campus was used to fumigate a number of common cultivars to determine their growth response to various levels and regimes of exposure. The experimental levels and regimes were a direct function of the ambient levels and regimes. These were processed through a computerized feedback mechanism to determine the experimental levels of ozone.

Report: Further information is available from V.C. Runeckles of the Plant Science Department, UBC. A final report is expected to be available from the Ministry of Environment after March 31, 1986.

9.2 ALBERTA

Compressor Station Stack Design

The objective of this study is to prepare and evaluate a calculation procedure for predicting the nitrogen dioxide (NO_2) concentration in the vicinity of natural gas compressor station stack design. An existing model will be modified as required and validated using available data.

Report: A final report will be available from the Canadian Petroleum Association at the end of the project.

The Effects of Atmospheric Pollutants on Corrosion Rates of Metals — A Literature Review

The project has two objectives: to determine whether air pollutants cause premature rusting of metals (e.g., fences) and to identify other variables that may accelerate or decelerate corrosion processes. To accomplish these objectives, a review of both published and unpublished data, with emphasis on that relevant to Western Canada, was conducted during the last quarter of 1985.

Report: No report is available at this time. For further information, contact the Canadian Petroleum Association.

Alberta Government and Industry Acid Deposition Research Program

An agreement to commission major studies to assess the long-term environmental impact of acid forming gases was reached on March 17, 1983 between various industry sponsors and the Alberta Government. Forty percent of the funding for this Acid Deposition Research Program (ADRP) is being provided by the Canadian Petroleum Association and Alberta utilities; 10 percent of the funding is provided through the Alberta Energy Resources Conservation Board; and the remaining 50 percent through Alberta Environment. It is expected that over $8 million will be spent on the ADRP over its seven-year life. The ADRP, in fulfilment of its goal to determine and clarify justification for public concern regarding acid gas impacts and to identify potential solutions, has commissioned research into biophysical, medical/human health, and occupational health effects of acid forming gases in Alberta.

Report: Two annual reports have been issued to date. A major report on a medical diagnostic review research component of the program is expected in mid-1986, and a report on the Biophysical Research Program is anticipated in 1987. Completed reports are available from the ADRP office.

9.3 SASKATCHEWAN

Saskatchewan Power Corporation Monitoring Activities at Poplar River (Coronach) and Boundary Dam (Estevan) Power Stations

Two stations continuously monitoring ground level concentrations of sulphur dioxide are located at the U.S. border. One is located south of the Poplar River Power Station and the other south of the Boundary Dam Power Station. Emissions at the Poplar River Power Station are continuously monitored for opacity, sulphur dioxide, and nitrogen oxides concentrations. Surface waters in the vicinity of the Poplar River, Boundary Dam, Queen Elizabeth, and Estevan power stations are monitored and analysed for pH, sulphates, nitrates, alkalinity, etcetera.

Report: Further information is available from the Saskatchewan Power Corporation and the Water Pollution Control Branch, Saskatchewan Environment.

Saskatchewan Power Corporation Agricultural Monitoring Program — Poplar River Power Plant

As part of this program, the Saskatchewan Research Council measured sulphation levels at three sites. Rainfall samples at six sites were collected and analysed for pH, sulphate, nitrate, calcium, magnesium, potassium, sodium, chloride, and specific conductance. Soil chemistry was monitored for pH and sulphur content and wheat crops were analysed for chlorophyll-*a*, chlorophyll-*b*, nitrogen, and sulphur.

Report: Further information is available from the Saskatchewan Power Corporation.

Low NO_x/SO_x Burners

The Saskatchewan Power Corporation is conducting a study on the effectiveness of burners designed to reduce the quantities of nitrogen oxides and sulphur dioxides being emitted from coal-fired power plants. A boiler at the Boundary Dam Power Plant has been modified for this study. The testing began late in 1985.

Report: Reports and information are available from the Director, Coal and Gas Research and Development Centre, Saskatchewan Power Corporation.

Monitoring at AMOK Ltd. Uranium Mine, Cluff Lake

The average sulphation levels are determined on a monthly basis at 23 sites around the mine using lead peroxide plates.

Report: Data summaries are available from Amok Ltd. and Saskatchewan Environment.

Monitoring at Eldor Mines Uranium Mine, Rabbit Lake

Eldor Mines continuously monitors ground level concentrations of sulphur dioxide at one site.

Report: Data summaries are available from Eldor Mines and Saskatchewan Environment.

9.4 MANITOBA

Monitoring in Thompson

A permanent station continuously monitoring ground level concentrations of sulphur dioxide is located to the northwest of the Inco non-ferrous smelter facility located between the plant and the town of Thompson. A mobile station is used during the spring, summer, and early fall (during the growing season) to monitor sulphur dioxide concentrations from other directions.

In addition to measuring ground level concentrations of sulphur dioxide, there is a meteorological program to regulate the smelter production so that acceptable concentrations of sulphur dioxide are maintained under differing dispersion conditions.

Satellite imagery is being used to detect and map vegetation changes in the Thompson area. Maps have been prepared for 1973, 1978, and 1983.

Report: Data summaries are available from Inco Limited.

Removal of Sulphur

A research program is being conducted by Inco Ltd., Manitoba Division on the reduction of sulphur in the concentrate being smelted. The program, which is sponsored under the Canada/Manitoba Mineral Resources Development Agreement, is investigating techniques for increased removal of high sulphur pyrrhotite in the mill with minimization of metal losses.

Report: This is an ongoing program. Further information is available through Inco Limited.

Monitoring in Flin Flon

Three stations continuously monitoring ground level concentrations of sulphur dioxide are located within 4.8 km of the 150 m high main stack of the non-ferrous smelter facility. A high volume sampling program measures airborne particulate levels and determines heavy metal concentrations at two sites located 0.8 and 4.8 km from the main stack. Dustfall is measured in the vicinity of the non-ferrous smelter facility at two locations 0.5 and 1.6 km from the main stack to determine particulates for total solids, dissolved solids, and ignition loss.

Report: Data summaries are available through Hudson Bay Mining and Smelting Company Limited.

The Effect of Increased Acidity on Swimbladder Regulation in the Fathead Minnow, *Pinephales nomelas*

Fish rely on swimbladder lift when in still water and hydrodynamic lift from swimming when in a current. The ability to control swimbladder volume is critical to holding position in streams and rivers and is essential for survival and reproduction. It was found that acid stressed fish could not regulate swimbladder volume as well as the control fish when they experienced a change in water velocity.

Report: Further information is available from Dr. J.H. Gee, Zoology Department, University of Manitoba.

10. ADDRESSES FOR FURTHER INFORMATION

British Columbia

British Columbia Ministry of Environment
Parliament Buildings
Victoria, British Columbia
V8V 1X5

Department of Biology
University of Victoria
P.O. Box 1700
Victoria, British Columbia
V8W 2Y2

Department of Plant Science
University of British Columbia
2075 Westbrook Mall
Vancouver, British Columbia
V6T 1W5

Alberta

Acid Deposition Research Program
1500 - 633 Sixth Avenue, S.W.
Calgary, Alberta
T2P 2Y5

Alberta Environment
Pollution Control Division
6th floor, Oxbridge Place
9820 - 106 Street
Edmonton, Alberta
T5K 2J6

Alberta Environment
Research Management Division
14th floor, Standard Life Centre
10405 Jasper Avenue
Edmonton, Alberta
T5J 3N4

Alberta Environment
Technical Development Branch
Earth Sciences Division
P.O. Box 3014
Cousins Building
Lethbridge, Alberta
T1J 4B3

Alberta Environmental Centre
Environmental Technology Wing
Bag 4000
Vegreville, Alberta
T0B 4L0

Alberta Environmental Centre
Toxicology Group
Animal Sciences Wing
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Vegreville, Alberta
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Canadian Petroleum Association
1500 - 633 Sixth Avenue, S.W.
Calgary, Alberta
T2P 2Y5

Saskatchewan

Amok Ltd.
817, 825 - 45th Street West
P.O. Box 9204
Saskatoon, Saskatchewan
S7K 3X7

Eldor Mines
P.O. Box 2070
Saskatoon, Saskatchewan
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Institute of Pedology
University of Saskatchewan
Saskatoon, Saskatchewan
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Saskatchewan Environment
Walter Scott Building
3085 Albert Street
Regina, Saskatchewan
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Saskatchewan Power Corporation
2025 Victoria Avenue
Regina, Saskatchewan
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Saskatchewan Research Council
15 Innovation Boulevard
Saskatoon, Saskatchewan
S7N 2X8

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University of Manitoba
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R3T 2N2

Hudson Bay Mining and Smelting Company Ltd.
Supervisor Environmental Control
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Inco Ltd.
Director
Safety, Health and Environment
Manitoba Division
Thompson, Manitoba
R8N 1P3

Manitoba Environment and Workplace
Safety and Health
Environmental Standards and Studies
Box 7, Building 2
139 Tuxedo Avenue
Winnipeg, Manitoba
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Northwest Territories

Pollution Control Division
Renewable Resources
Government of the Northwest Territories
Yellowknife, Northwest Territories
X1A 2L9

Federal Agencies

Agriculture Canada
Sir John Carling Building
930 Carling Avenue
Ottawa, Ontario
K1A 0C5

Atmospheric Environment Service
Atmospheric Research Directorate
4905 Dufferin Street
City of North York
Downsview, Ontario
M3H 5T4

Atmospheric Environment Service
Scientific Services Division
Central Region
266 Graham Avenue
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Winnipeg, Manitoba
R3C 3V4

Atmospheric Environment Service
Scientific Services Division
Pacific Region
700 - 1200 West 73rd Avenue
Vancouver, British Columbia
V6P 6H9

Atmospheric Environment Service
Scientific Services Division
Western Region
2nd floor
Twin Atria Building
4999 - 98 Avenue
Edmonton, Alberta
T6B 2X3

Canadian Wildlife Service
Environment Canada
9942 - 108 Street
Edmonton, Alberta
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Department of Fisheries and Oceans
1090 West Pender Street
Vancouver, British Columbia
V6E 2P1

Environmental Protection Service
2nd floor, Twin Atria #2
4999 - 98 Avenue
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T6B 2X3

Environmental Protection Service
Mobile Sources Division
Ottawa, Ontario
K1A 1C8

Environmental Protection Service
Pacific Region
3rd floor, Kapilano 100
Park Royal
West Vancouver, British Columbia
V7T 1A2

Freshwater Institute
Department of Fisheries and Oceans
501 University Crescent
Winnipeg, Manitoba
R3T 2N6

Health and Welfare Canada
Brooke Claxton Building
Ottawa, Ontario
K1A 0K9

Inland Waters Directorate
Pacific and Yukon Region
Environment Canada
1001 West Pender Street
Vancouver, British Columbia
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Inland Waters Directorate
Western and Northern Region
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1901 Victoria Avenue
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Institute of Ocean Sciences
9860 West Saanich Road
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Lands Directorate
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506 West Burnside Road
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Northern Forest Research Centre
5320 - 122 Street
Edmonton, Alberta
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